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# TOPPING AND PINCHING VINES

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# TOPPING AND PINCHING VINES

By FREDERIC T. BIOLETTI and F. C. H. FLOSSFEDER

It is a common practice in California to cut off the ends of the growing shoots of vines during the late spring and early summer. In a few vineyards only the extreme tip is removed, but in many a large part of the shoot is destroyed, and the operation is often repeated.

In most cases the grape growers do not seem to have a very clear or logical idea of why they do this and there are theoretical reasons for believing that much of it is harmful. These reasons are discussed in detail in our Bulletin 241,* and also the various forms of summer or herbaceous pruning and the cases in which they are useful.

This bulletin gives an account of certain experiments which have been carried out at the University Farm to test the practical effects of these two commonest forms of summer pruning, topping and pinching.

Topping consists in cutting off one, two, or more feet of the growing shoots in summer or autumn. Pinching is removing with thumb and finger the extreme tip of the growing shoots in late spring and early summer. In the former, a considerable amount of foliage is removed; in the latter, hardly any.

The effects claimed for pinching are delay in the lengthening of the shoots and a consequent protection from wind injury and a more upright growth which tends to shade the fruit better and to permit of later irrigation and cultivation. When done before blossoming, it tends to cause better setting of the fruit. If applied to the first vigorous shoots it tends to favor the growth of the weaker and even to cause the growth of buds which otherwise would have remained dormant. Both of these effects are supposed to increase the crop. When done later, it encourages the growth of laterals on which the second crop is borne. Whether this second crop is wholly a gain or whether it is produced at the expense of the first crop does not seem to have been determined. Where the first crop is a failure owing to frost or other causes it is probably a clear gain. In other cases, it is doubtful, especially as the second crop is usually of inferior quality and often not worth harvesting. The production of laterals is sometimes useful, as in the case of Sultanina, because they supply fruit buds for the following year, making it possible to obtain a larger number of fruit buds on a short fruit cane.

* Vine Pruning in California, Part I, Bul. 241, College of Agriculture, Berkeley, California, pp. 30–39.

The effects claimed for topping are similar. It cannot, however, be applied before blossoming, so that it cannot be used to promote "setting." Another effect claimed for topping is that it increases the size of the grapes. This seems to be true, but at the expense of the sugar, flavor, and color of the fruit.

The weakening effect which is recognized to result from all considerable removals of foliage must be greater in the case of topping than of pinching.

To test some of the claims for these operations, a series of tests has been conducted at Davis for two years. The points investigated were the influence on the quantity of the crop, the influence on its quality as evidenced by the sugar contents of the grapes, and the influence on the vigor of the vine as evidenced by the annual growth of wood.

## METHODS AND RESULTS OF EXPERIMENTS

1. *Arrangement of the Experiments.*—Two small blocks of vines were chosen for the experiment. One consisted of 10 rows of Carignane, 220 vines in all, 3 years old in the spring of 1916; the other, of 10 rows of Tokay, 240 vines in all, 6 years old in the spring of 1916. All the vines were strong, healthy, in full bearing and growing in uniform, deep rich soil on the University Farm at Davis.

The arrangement of the experiments was as follows:

| | Rows | |
|---|---|---|
| *Carignane:* | | |
| No summer pruning | 11 | 16 |
| Pinched once | 12 | 17 |
| Pinched three times | 13 | 18 |
| Topped once | 14 | 19 |
| Topped three times | 15 | 20 |
| *Tokay:* | | |
| No summer pruning | 31 | 36 |
| Pinched once | 32 | 37 |
| Pinched three times | 33 | 38 |
| Topped once | 34 | 39 |
| Topped three times | 35 | 40 |

Each test was thus made in duplicate, both with the Carignane and with the Tokay. Both of these varieties are very vigorous, so that they might be expected to suffer less than most varieties from any treatment of a weakening nature. They are both regular and heavy bearers under ordinary conditions and therefore any variations in the crop might well be ascribed to the differences in summer pruning which were the only differences in treatment given.

2. *Length of Shoots Removed.*—In pinching, only the extreme tip of the growing shoot was removed, sufficient to stop temporarily the production of new joints and to delay the growth in length. Less than one inch of the shoot was removed each time.

After the first pinching, a new terminal shoot is usually formed from a side bud near the end from which the tip has been removed. This occurs after a delay of about a week or more. This pinching stimulates the growth of laterals. The second pinching is sometimes followed by a new terminal growth in the same way but usually results in transferring the main apical growth or elongation to one or more strong laterals. At the third pinching, it is the tips of these laterals which are removed.

In topping, from one-fifth to one-fourth of the length of the shoot was cut off. The length of the pieces removed varied according to the condition and vigor of the vine. In table I is given the average length of these pieces.

TABLE I

Length of Shoots Removed in Topping

| | 1916 | | | 1917 | | |
|---|---|---|---|---|---|---|
| | 1 cm. | 2 cm. | 3 cm. | 1 cm. | 2 cm. | 3 cm. |
| Carignane | 48 | 51 | 37 | 43 | 43 | 26 |
| Tokay | 65 | 48 | 53 | 45 | 47 | 33 |
| Approximate mean (inches) | 22 | 19 | 18 | 17 | 18 | 12 |

The average length of the tops removed for all cases is 17.7 inches. It was about 19 inches for the Tokay and 16 inches for the Carignane which normally has shorter canes. In 1916 the average length was about 20 inches and in 1917 about 16, showing a less rapid or vigorous growth during the second season. The third topping tends to remove shorter pieces on account of the slackening of growth due to the approach of the dormant season and the weakening caused by previous toppings.

3. *Number of Tips or Shoots Removed.*—The average number of tips removed per vine for each operation during 1917 was 31 in the case of pinching and 23 in the case of topping.

The increase in the number of removals from about 16 at the first operation to 33 and 36 at the later operations indicates the increase of growing tips due to the development of laterals and the growth of the shorter and later starting shoots. The number of tips and shoots removed in 1916 averaged 30 per vine for each operation and 25 in 1917, indicating a less abundant growth for the latter season.

TABLE II

NUMBER OF SHOOTS REMOVED PER VINE

| | 1 | 2 | 3 |
|---|---|---|---|
| Carignane, pinching, 1916 | 17 | .... | .... |
| Carignane, topping, 1916 | 14 | 33 | 27 |
| Tokay, pinching, 1916 | .... | .... | .... |
| Tokay, topping, 1916 | 17 | 33 | 53 |
| Carrignane, pinching, 1917 | 18 | 33 | 29 |
| Carignane, topping, 1917 | 18 | 27 | 12 |
| Tokay, pinching, 1917 | 15 | 39 | 52 |
| Tokay, topping, 1917 | 16 | 35 | 41 |
| Averages | 16.4 | 33.3 | 35.7 |

4. *Weight of Material Removed.*—In pinching, the weight of material removed is extremely small and was not measured. It is so minute that any effect produced by the operation can hardly be ascribed to the actual loss of material.

In topping, on the other hand, a considerable weight of material is taken from the vine. With three toppings this varied from 3724 pounds per acre, with the vigorous Tokays, during 1916, to 1615 pounds, with the weakened Carignane, during 1917. It averaged 2598 pounds for both varieties and both years. A single topping removed from 206 pounds per acre with Carignane to 1700 pounds with Tokay. This large amount of material seems sufficient to account for a weakening of the vine. That it is not the only factor, however, is shown by the fact that three pinchings which removed a negligible weight of material was in some cases more weakening than one topping which removed more than 500 pounds of shoots and foliage from an acre. The reason is discussed on page 379.

TABLE III

MATERIAL REMOVED BY TOPPING

(Weight of shoots removed, in pounds, per acre)

| | 1 | 2 | 3 | Total |
|---|---|---|---|---|
| Carignane, 1916 | 605 | 1,296 | 707 | 2,608 |
| Tokay, 1916 | 749 | 1,275 | 1,700 | 3,724 |
| Average, 1916 | 677 | 1,286 | 1,204 | 3,166 |
| Carignane, 1917 | 614 | 795 | 206 | 1,615 |
| Tokay, 1917 | 533 | 1,128 | 782 | 2,443 |
| Average, 1917 | 574 | 962 | 494 | 2,029 |

5. *Cost of Pinching and Topping.*—The cost of the operations is shown in Table 4. The cost of topping was on the average about 30 per cent greater than that of pinching. The cost of one pinching was less than two dollars per acre and would be counterbalanced by a small increase of crop. The cost of topping three times was nearly ten dollars per acre and would require an increase of about 1300 pounds of grapes, to reimburse for the labor used, at the price for which the crop was sold.

TABLE IV

COST OF TOPPING AND PINCHING

Per acre

| | Time in hours | | |
|---|---|---|---|
| | 1st | 2d | 3d |
| 1916: | | | |
| Pinching Carignane | 6.1 | 10.0 | 15.1 |
| Pinching Tokay | ..... | 10.0 | 19.3 |
| Topping Carignane | 7.2 | 13.8 | 12.2 |
| Topping Tokay | 8.0 | 17.3 | 20.0 |
| 1917: | | | |
| Pinching Carignane | 6.2 | ..... | 8.1 |
| Pinching Tokay | 9.1 | ..... | 12.8 |
| Topping Carignane | 9.5 | ..... | 6.3 |
| Topping Tokay | 13.3 | ..... | 14.0 |

Average cost per acre at 25 cents per hour:

| | Once | Twice | Three times |
|---|---|---|---|
| Pinching | $1.91 | $4.40 | $7.86 |
| Topping | 2.38 | 6.27 | 9.55 |

6. *Effect on Weight of Crop.*—The benefit usually expected from summer pruning is an increase in the crop. Pinching once increased the crop of Carignane about 16% the first year, but decreased it about 11% the second year. Pinching once increased the crop of Tokay nearly 5% and pinching three times about 11% the first year but decreased it 16% and 21%, respectively, the second year. Topping once increased the crop of Tokay 8.5% the first year but decreased it about 32% the second year. In all other cases for both years and for both varieties there was a decrease of crop. In all cases, the total crop for the two years was less on the pinched and topped vines than on the check where no summer pruning was done, except in case of pinching once on the Carignane (see Table 5).

TABLE V

EFFECT ON WEIGHT OF CROP

(Yield in pounds per acre of first and second crop)

| | None | Once | Three times |
|---|---|---|---|
| 1916: | | | |
| Pinching, Carignane | 27,447 | 31,644 | 27,246 |
| Pinching, Tokay | 21,117 | 22,899 | 23,463 |
| Topping, Carignane | 27,447 | 27,090 | 18,351 |
| Topping, Tokay | 21,117 | 22,437 | 16.132 |
| 1917: | | | |
| Pinching, Carignane | 24,360 | 21,600 | 19,920 |
| Pinching, Tokay | 19,200 | 16,140 | 15,120 |
| Topping, Carignane | 24,360 | 19,500 | 12,090 |
| Topping, Tokay | 19,200 | 13,140 | 11.670 |

(In per cent of crop of untreated vines)

| | 1916 | | | 1917 | | | Total 1916–1917 | | |
|---|---|---|---|---|---|---|---|---|---|
| | None | 1 | 3 | None | 1 | 3 | None | 1 | 3 |
| Pinching, Carignane | 100 | 115.6 | 88.5 | 100 | 88.7 | 81.8 | 100 | 102.2 | 85.2 |
| Pinching, Tokay | 100 | 104.6 | 111.1 | 100 | 84.1 | 78.7 | 100 | 94.4 | 94.9 |
| Topping, Carignane | 100 | 96.7 | 67.9 | 100 | 80.1 | 49.6 | 100 | 88.4 | 58.8 |
| Topping, Tokay | 100 | 108.5 | 76.4 | 100 | 68.2 | 60.8 | 100 | 88.4 | 68.6 |

7. *Effect on Second Crop.*—As summer pruning encourages the growth of laterals, it is supposed to increase the weight of second-crop grapes, all of which are borne on laterals. In most cases, an actual increase was found but it was not very large. Where the vines were topped three times there was an actual decrease of the weight of second crop (see Table 6).

TABLE VI

EFFECT ON SECOND CROP OF CARIGNANE

| Method | Total per vine, lbs. | 2d crop lbs. | Per cent of total |
|---|---|---|---|
| 1916: | | | |
| No pruning | 48.8 | 12.6 | 25.8 |
| Pinching, 1 | 52.7 | 16.8 | 31.9 |
| Pinching, 3 | 45.4 | 14.7 | 32.4 |
| Topping, 1 | 45.2 | 13.9 | 30.8 |
| Topping, 3 | 31.1 | 9.7 | 31.2 |
| 1917: | | | |
| No pruning | 40.6 | 4.5 | 11.1 |
| Pinching, 1 | 36.0 | 7.4 | 20.6 |
| Pinching, 3 | 33.2 | 5.1 | 15.4 |
| Topping, 1 | 32.5 | 4.8 | 14.8 |
| Topping, 3 | 20.2 | 1.7 | 8.4 |

8. *Effect on Sug[illegible]t.*—It is a well-recognized fact that as a rule the sugar co[illegible] of the grapes varies inversely with the crop

and directly with the vigor of the vine. The low sugar content of the fruit in 1916 of the vines which were pinched once (14% less than that of the unpruned vines) is therefore accounted for by the larger crop which was 15.6% more. These two tendencies, however, in most cases tend to neutralize each other. The summer pruning by weakening the vines tends to lower the sugar content, but by decreasing the crop it tends to raise the sugar content. The net result is fairly constant sugar content in the various lots. An exception to this is shown in the last experiment where the heavy summer pruning of three toppings weakened the vines so much that the sugar content was low in spite of the small crop (see Table 7).

TABLE VII

EFFECT ON SUGAR CONTENT (CARIGNANE)

| | Bal. 1916 | | Bal. 1917 | | Average |
|---|---|---|---|---|---|
| | 1st crop | 2d crop | 1st crop | 2d crop | (weighted) |
| No pruning | 22.8 | 18.8 | 22.4 | 15.8 | 21.7 |
| Pinching, 1 | 19.8 | 16.8 | 22.1 | 16.4 | 19.9 |
| Pinching, 3 | 20.5 | 15.3 | 21.9 | 17.0 | 19.8 |
| Topping, 1 | 21.5 | 17.3 | 21.5 | 17.4 | 20.5 |
| Topping, 3 | 19.0 | 15.5 | 17.4 | 15.8 | 17.6 |

TABLE VIII

GAINS AND LOSSES FROM PINCHING AND TOPPING, PER ACRE

| | 1916 | | | 1917 | | | |
|---|---|---|---|---|---|---|---|
| | Crop value $ | Cost of treatment $ | Gain or loss† $ | Crop value $ | Cost of treatment $ | Gain or loss† $ | Total loss in two years $ |
| *Carignane:** | | | | | | | |
| No summer pruning | 206 | ..... | ..... | 183 | ..... | ..... | ..... |
| Pinching once | 206 | 1.53 | −1.53 | 160 | 1.55 | −24.55 | −26.08 |
| Pinching 3 times | 184 | 7.80 | −29.80 | 146 | 6.08 | −43.08 | −72.88 |
| Topping once | 192 | 1.80 | −15.80 | 140 | 2.38 | −45.38 | −61.18 |
| Topping 3 times | 115 | 8.30 | −99.30 | 70 | 7.40 | −120.40 | −219.70 |
| *Tokay:** | | | | | | | |
| No summer pruning | 158 | ..... | ..... | 144 | ..... | ..... | ..... |
| Pinching once | 172 | 2.25 | +11.75 | 121 | 2.28 | −15.28 | −3.53 |
| Pinching 3 times | 176 | 9.60 | +8.40 | 113 | 7.98 | −38.98 | −30.58 |
| Topping once | 168 | 2.00 | +8.00 | 99 | 3.33 | −48.33 | −40.33 |
| Topping 3 times | 121 | 11.33 | −37.00 | 88 | 11.15 | −67.15 | −104.15 |

† Figures preceded by + represent gain; by −, loss.

* The value of the crop was calculated on the basis of $15 per ton, the price for which it was sold. In estimating the value of the Carignane grapes this price was reduced in proportion to the difference between the Balling degree of the grapes of the particular experiment and that of the grapes of the untreated rows. The loss of the Carignane, therefore, represents loss both in quantity and quality; of the Tokay, only in quantity and the cost of the summer pruning.

9. *Gains and Losses.*—If we consider the differences in quantity of crop and quality, as measured by the sugar contents, and deduct the cost of the operations there was a loss in all cases from all forms of pinching and topping during the two years. This loss varied from $3.53 per acre for the Tokay, which were pinched once, to $104.15, where they were topped three times. The slight gains in crop with the Tokay in 1916 were in all cases more than counterbalanced by the losses during 1917. There was in no case any gain with the Carignane and the total losses for the two crops varied from $26.08 in the case of one pinching, to $219.70 in the case of three toppings (see Table 8).

10. *Effect on Vigor of Vines.*—Under conditions favorable to bearing, the most vigorous vines will produce the most grapes. Any decrease of vigor, therefore, diminishes the possibilities of bearing. Under conditions of soil, climate, or variety unfavorable to bearing, a moderate decrease of vigor, on the other hand, may result in larger crops. The conditions of these experiments were of the former kind.

The vigor of the vines was estimated by weighing the material removed at each winter pruning. This is perhaps as accurate a method as could be devised, as the weight represents both the volume of the growth, and, to some extent, its composition. The more vigorous and healthy the vine, the better it nourishes and matures its wood. The better nourished and matured the wood, the more reserve food supplies it contains and therefore the higher its specific gravity.

Table 9 shows the results of the weighings, and calculations of the relative vigor of the vines of the various experiments expressed in percentages of the vigor of the comparison rows.

TABLE IX

Effect on Vigor of Vines

(Average weight of prunings per vine)

| | 1916 | | 1917 | | |
|---|---|---|---|---|---|
| Experiment | 1<br>lbs. | 2<br>Per cent<br>of check | 3<br>lbs. | 4<br>Per cent<br>of check | 5<br>Per cent<br>of 1916 |
| Carignane, no summer pruning | 5.28 | 100.00 | 5.23 | 99.1 | 99.1 |
| Carignane, pinched once | 5.11 | 96.80 | 3.67 | 69.6 | 71.8 |
| Carignane, pinched three times | 4.51 | 85.40 | 3.16 | 59.9 | 70.1 |
| Carignane, topped once | 4.70 | 89.00 | 3.04 | 57.6 | 64.7 |
| Carignane, topped three times | 3.64 | 68.9 | 1.63 | 30.8 | 44.8 |
| Tokay, no summer pruning | 6.62 | 100.0 | 5.11 | 77.2 | 77.2 |
| Tokay, pinched once | 6.25 | 94.4 | 4.16 | 62.8 | 66.6 |
| Tokay, pinched three times | 5.13 | 77.5 | 3.44 | 52.0 | 67.1 |
| Tokay, topped once | 6.13 | 92.6 | 3.47 | 52.3 | 56.8 |
| Tokay, topped three times | 4.08 | 61.6 | 1.96 | 29.5 | 48.0 |

The percentage columns show that in all cases summer pruning decreased the vigor and that this decrease was much greater the second year than the first (see columns 2 and 4, Table 9 and Table 10).

TABLE X

Loss of Vigor of Vines

(In per cent of 1916 check rows)

| | Carignane | | Tokay | |
|---|---|---|---|---|
| | 1916 | 1917 | 1916 | 1917 |
| No summer pruning | ..... | .9 | ..... | 22.8 |
| Pinching once | 3.2 | 30.4 | 5.6 | 37.2 |
| Pinching three times | 14.6 | 40.1 | 22.5 | 48.0 |
| Topping once | 11.0 | 42.4 | 7.4 | 47.7 |
| Topping three times | 31.1 | 69.2 | 38.4 | 70.5 |

The percentage of loss of vigor in Table 10 for 1916 and 1917 is found by subtracting the percentages of growth in columns 2 and 4 in Table 9 from 100.

The total loss of vigor for 1917 is made up of the loss due to a less favorable season, the loss due to the effect of summer pruning in 1917, and the loss due to the residual effect of summer pruning in 1916.

The check rows of Tokay produced only about three-quarters the growth in 1917 that they did in 1916. The check rows of Carignane, however, were practically as vigorous in 1917 as in 1916. In the latter case, therefore, the observed weakening of the summer pruned rows may be considered as uninfluenced by the season. The observed weakening is much more than would be found if there were the same percentage of weakening the second year as the first. The excess is therefore a residual effect of the summer pruning of the previous year.

A consideration of Tables 9 and 10 shows that there was a decrease of vigor in all cases of summer pruning, varying from the negligible amount of 3.2% due to one pinching of Carignane for one year to the extreme degree of weakening indicated by 70.5% due to three toppings of Tokay on each of two consecutive years.

The direct weakening from pinching once was very small and much less than from pinching three times the first year. During the second year there was a considerable weakening from pinching of both kinds and but little difference whether the vines were pinched once or three times. This contrast between the two years may be explained by the fact that the late new succulent growth induced by the repeated pinchings was destroyed by early autumn frosts the first year, while the long dry autumn of the second year allowed all the growth to mature.

The same explanation may account for the fact that one topping which might be expected to be more weakening than several pinchings as it removes far more foliage, was actually less weakening than three pinchings, especially during the first year.

Three toppings were in all cases extremely detrimental to the vigor of the vines with both varieties and in both years.

The variations in vigor of the different lots is shown clearly by figures 1 and 2. Figure 2 is a photograph of five piles of canes, each consisting of all the material removed in winter pruning a row of


Fig. 1
All the canes removed in winter pruning five typical vines in 1917.

Carignane vines in December, 1917. Figure 1 is a photograph of all the canes removed in the pruning of adjacent single average vines from each row.

T3 T1 P3 P1 C

C = No summer pruning. P3 = Pinched three times. P1 = Pinched once.
T3 = Topped three times. T1 = Topped once.

Fig. 2

All the canes removed in winter pruning five typical rows in 1917.

11. *Composition of the Mature Wood.*—Directly after pruning the vines in 1917, samples of the canes were taken for analysis. These samples were chosen in such a way as to make them representative and comparable. They were analyzed at the Viticultural Laboratory at Berkeley by Mr. J. R. Zion. Four samples, each representing a different row, were taken from each experiment lot and analyzed separately.

The averages of the sets of analyses are given in Tables XI, XII, and XIII.

TABLE XI

COMPOSITION OF THE MATURE WOOD (CANES)

(Calculated on the dry weight)

| Experiment | Row | % Moisture | % Starch | % Sugar | % Protein | % Ash |
|---|---|---|---|---|---|---|
| *Carignane:* | | | | | | |
| Check ..... | 11, 16 | 43.9 | 21.89 | 4.66 | 3.18 | 1.92 |
| Pinched 1 .... | 12, 17 | 42.9 | 25.13 | 4.10 | 2.82 | 1.87 |
| Pinched 3 .... | 13, 18 | 45.5 | 24.08 | 4.84 | 2.76 | 2.12 |
| Topped 1 .... | 14, 19 | 46.9 | 25.67 | 4.84 | 3.09 | 2.30 |
| Topped 3 .... | 15, 20 | 48.7 | 23.60 | 5.80 | 4.73 | 2.30 |
| *Tokay:* | | | | | | |
| Check ..... | 31, 36 | 47.7 | 23.39 | 5.04 | 2.71 | 2.48 |
| Pinched 1 .... | 32, 37 | 47.3 | 23.54 | 3.72 | 2.87 | 2.76 |
| Pinched 3 .... | 33, 38 | 48.2 | 23.49 | 4.88 | 2.46 | 2.79 |
| Topped 1 .... | 34, 39 | 48.9 | 21.69 | 6.00 | 2.96 | 2.94 |
| Topped 3 .... | 35, 40 | 52.8 | 22.05 | 5.28 | 2.87 | 3.04 |

The moisture contents are lowest and the starch contents highest in the cases where the vines were pinched once. This indicates a more perfect maturity of the wood. All other treatments increased the moisture, indicating less perfect maturity in proportion to the amount of pruning. The improved condition of the wood, following one pinching, is marked only in the Carignane and the injurious action of the other treatments is more marked in the Tokay.

TABLE XII

AVERAGES FOR THE TWO VARIETIES

(Calculated on the dry weight)

| Experiment | Row | % Moisture | % Starch | % Sugar | % Protein | % Ash |
|---|---|---|---|---|---|---|
| Check ..... | 11, 16, 31, 36 | 45.8 | 22.64 | 4.85 | 2.94 | 2.20 |
| Pinched 1 | 12, 17, 32, 37 | 45.1 | 24.33 | 3.91 | 2.84 | 2.31 |
| Pinched 3 | 13, 18, 33, 38 | 46.8 | 23.78 | 4.86 | 2.61 | 2.45 |
| Topped 1 | 14, 19, 34, 39 | 47.9 | 23.68 | 5.42 | 3.02 | 2.62 |
| Topped 3 | 15, 20, 35, 40 | 50.7 | 22.82 | 5.54 | 3.80 | 2.67 |

TABLE XIII

AVERAGES OF THE TWO VARIETIES

(Calculated on the weight of the fresh samples)

| Experiment | Dry matter % | Starch % | Sugar % | Protein % | Ash % |
|---|---|---|---|---|---|
| Check ..... | 54.2 | 12.27 | 2.63 | 1.59 | 1.19 |
| Pinched 1..... | 54.9 | 13.36 | 2.15 | 1.56 | 1.27 |
| Pinched 3..... | 53.2 | 12.65 | 2.59 | 1.39 | 1.30 |
| Topped 1 ..... | 52.1 | 12.34 | 2.82 | 1.57 | 1.37 |
| Topped 3 ..... | 49.3 | 11.25 | 2.73 | 1.87 | 1.32 |

The ash of the Carignane samples is affected in a manner parallel to that of the moisture. Pinching once decreased it, while other treatments increased it in accord with their severity.

According to L. du Sablon[1] the proportion of ash in the dry matter of plant stems decreases with maturity. These ash determinations then indicate, like the moisture determinations, that tipping once favored the maturity of the wood of the Carignane but that all severer summer pruning delayed maturity. All forms delayed maturity in the Tokay.

L. du Sablon states further:[2] "There is an absolute increase of the ash with age, but as the organic matter increases more rapidly than the mineral matter, the proportion of the latter diminishes." Tables XII and XIII show that the greater contents of ash in the wood of the vines summer pruned is not only relative but absolute. A general

[1] *Traité de Physiologie Végétale et Agricole*, p. 285.

[2] *Loc. cit.*, p. 286.

characteristic of diseased plants is an increase of ash. It seems probable, therefore, that summer pruning not only interferes with the proper maturing of the wood but has some pathological effect also.

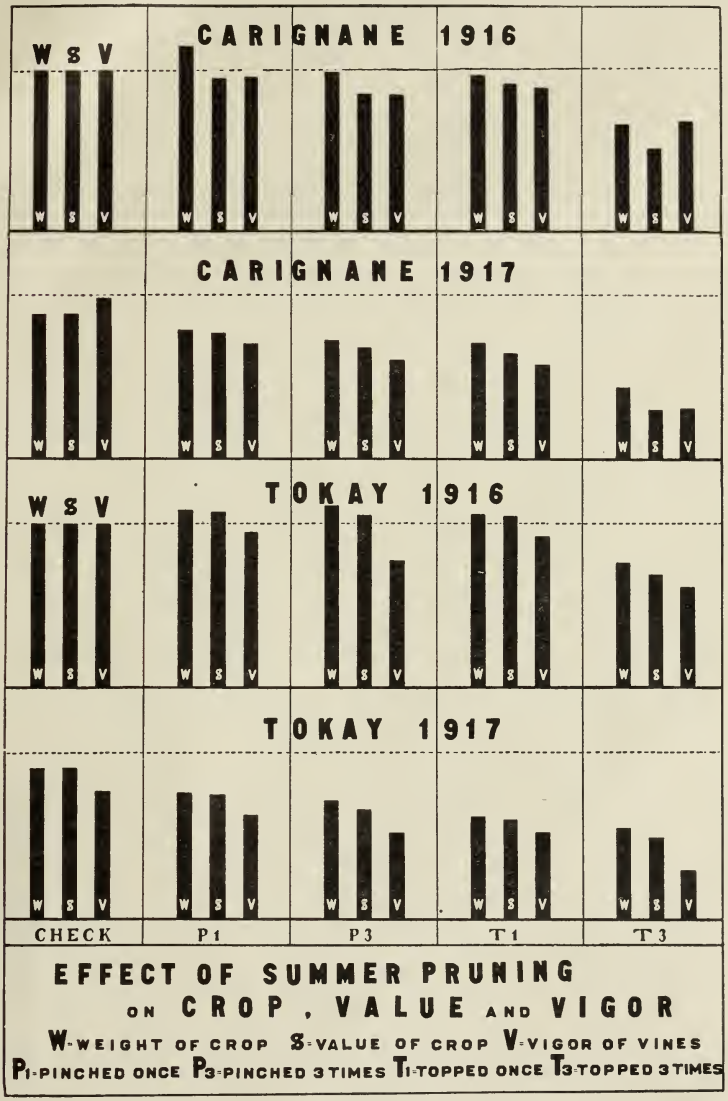


Fig. 3

## SUMMARY

A summary of the results of this investigation is given graphically in figure 3.

Each experiment is represented by a group of three black columns

for 1916 and another group of three for 1917. The first column of each group represents the weight of crop, the second, the value of this crop minus the cost of the summer pruning, and the third, the vigor of the vines.

There was in all cases a net loss in value of crop and vigor of vines for the two years as follows:

NET LOSS IN TWO YEARS FROM SUMMER PRUNING

| | Carignane | | Tokay | |
|---|---|---|---|---|
| | Crop, dollars per acre | Vigor, per cent | Crop, dollars per acre | Vigor, per cent |
| One pinching | 26 | 29 5 | 4 | 14.4 |
| Three pinchings | 73 | 39.2 | 31 | 25.2 |
| One topping | 61 | 41.5 | 40 | 24.9 |
| Three toppings | 220 | 68.3 | 104 | 47.7 |

## CONCLUSIONS

We may conclude from these results that both pinching and topping are harmful under conditions similar to those under which the experiments were conducted.

That very heavy topping continued year after year may almost ruin a vineyard.

That topping is more harmful than pinching but that even the latter, contrary to the usual belief, is both weakening and detrimental to the crop.

It should not be overlooked, that these conclusions apply only to the conditions of the experiments.

Many varieties, when growing in excessively rich soil abundantly supplied with nitrogen, humus, and water, are often unfruitful owing to an excess of vigor, and moderate summer pruning might result in better crops without dangerously weakening the vines.

Some varieties, moreover, produce few fruit buds on the main canes but produce them abundantly on the laterals. Moderate pinching or even topping in such cases might be necessary to promote the growth of fruitful laterals.

Topping or, better, pinching, is also necessary under some conditions where heavy winds are liable to break off whole shoots. It should be done, however, with a realization that the only object in view is to prevent a more serious injury.

Probably four-fifths of the topping practiced in California is inadvisable. It should never be applied to Muscats or similar vines of weak growth nor to any varieties when not excessively vigorous. It is less harmful to young vines than old and is most useful for two and three-year-old vines to get them into the proper shape before they bear.